

Immunology of Fish

Dublin 2005

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Immunology of Fish

- Well developed specific & non-specific systems
- Similar to mammals functionally but tendency towards less structural differentiation of components

Innate Immunity

- First line of defence
- Non-specific
- Physical barriers – skin, mucus, gut wall
- Gene silencing
- Tissues contain soluble factors & several cell types ->

Soluble Factors

- Growth inhibitors – transferrin
- Lysins – complement, lysozyme
- Agglutinins and precipitins
- Enzyme Inhibitors – antiproteinases
- C Reactive Protein (CRP) – activates complement cascade (C3 highly polymorphic)
- Interferon - antiviral

Cells in Innate Response

1) Non-specific cytotoxic (NCC) cells

- lymphocytes
- similar function to NK cells mammals
- poorly understood in fish
- non-specifically kill infected cells by lysis

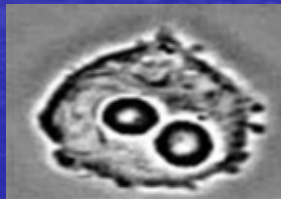
2) Phagocytes:

- have key role (also in specific response)

Phagocytosis



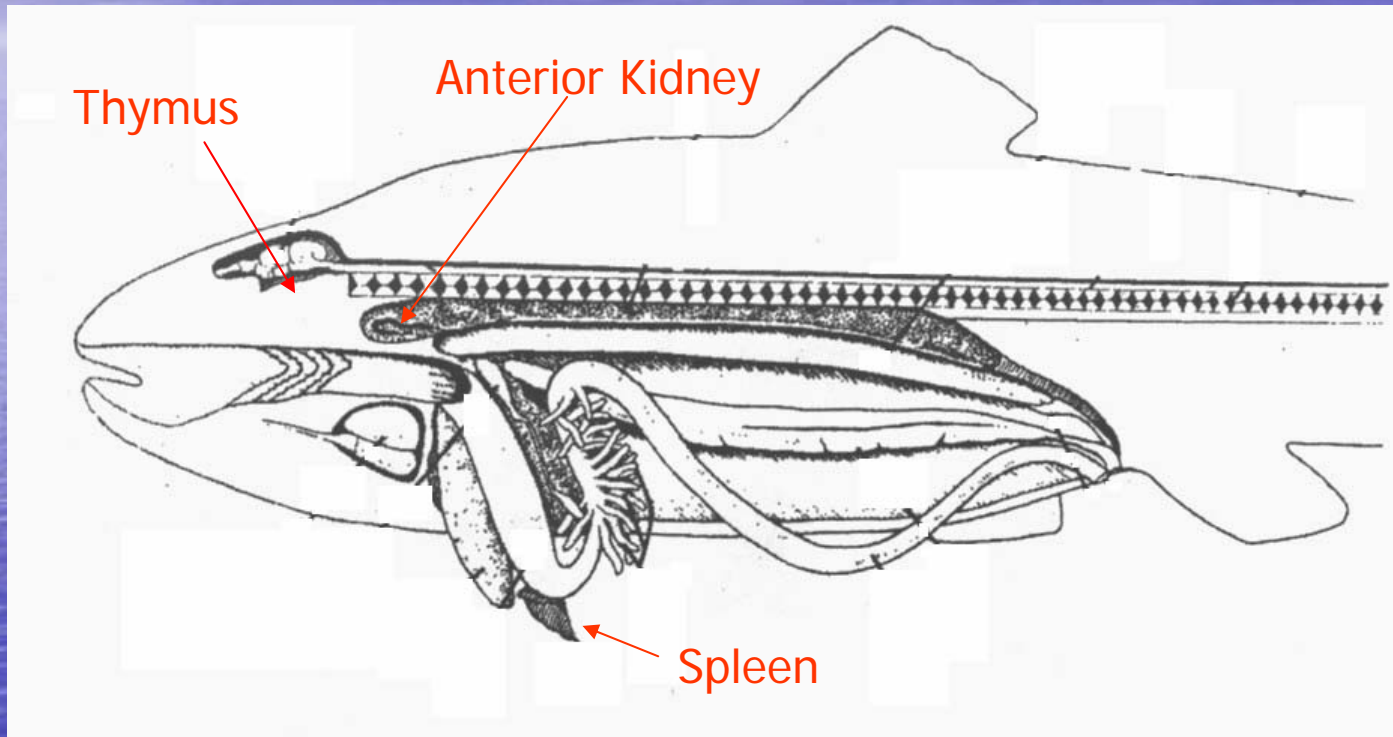
Respiratory Burst



But: Renibacterium
Photobacterium

Adaptive (specific) Immunity

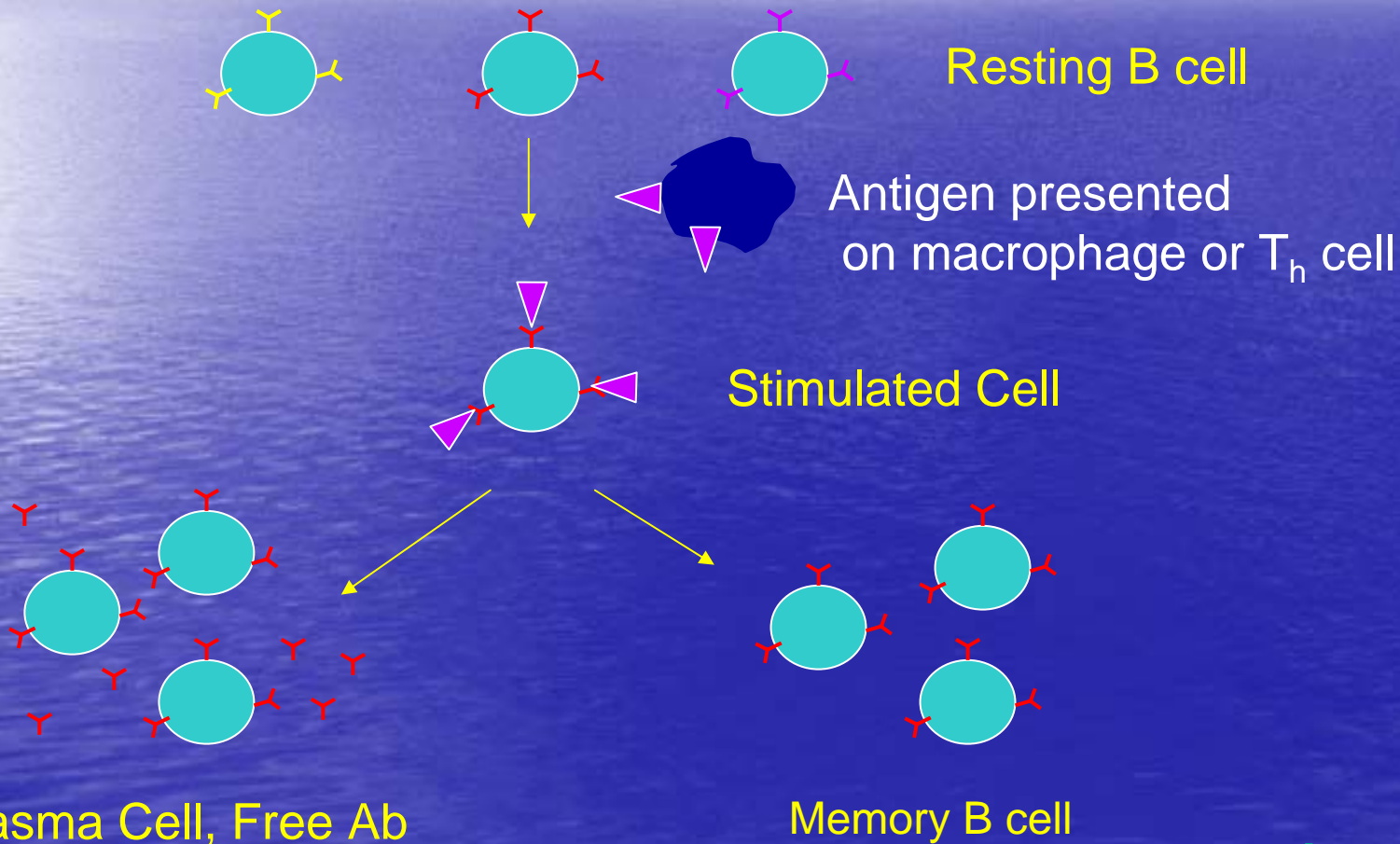
Fish Lymphoid Organs



No bone marrow or lymph nodes

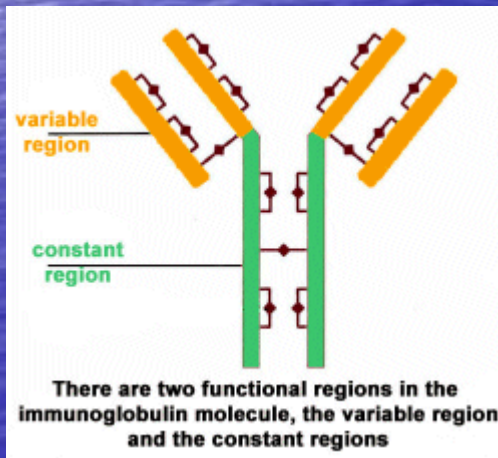
Adaptive Immunity

- B & T cells – much argued but now accepted

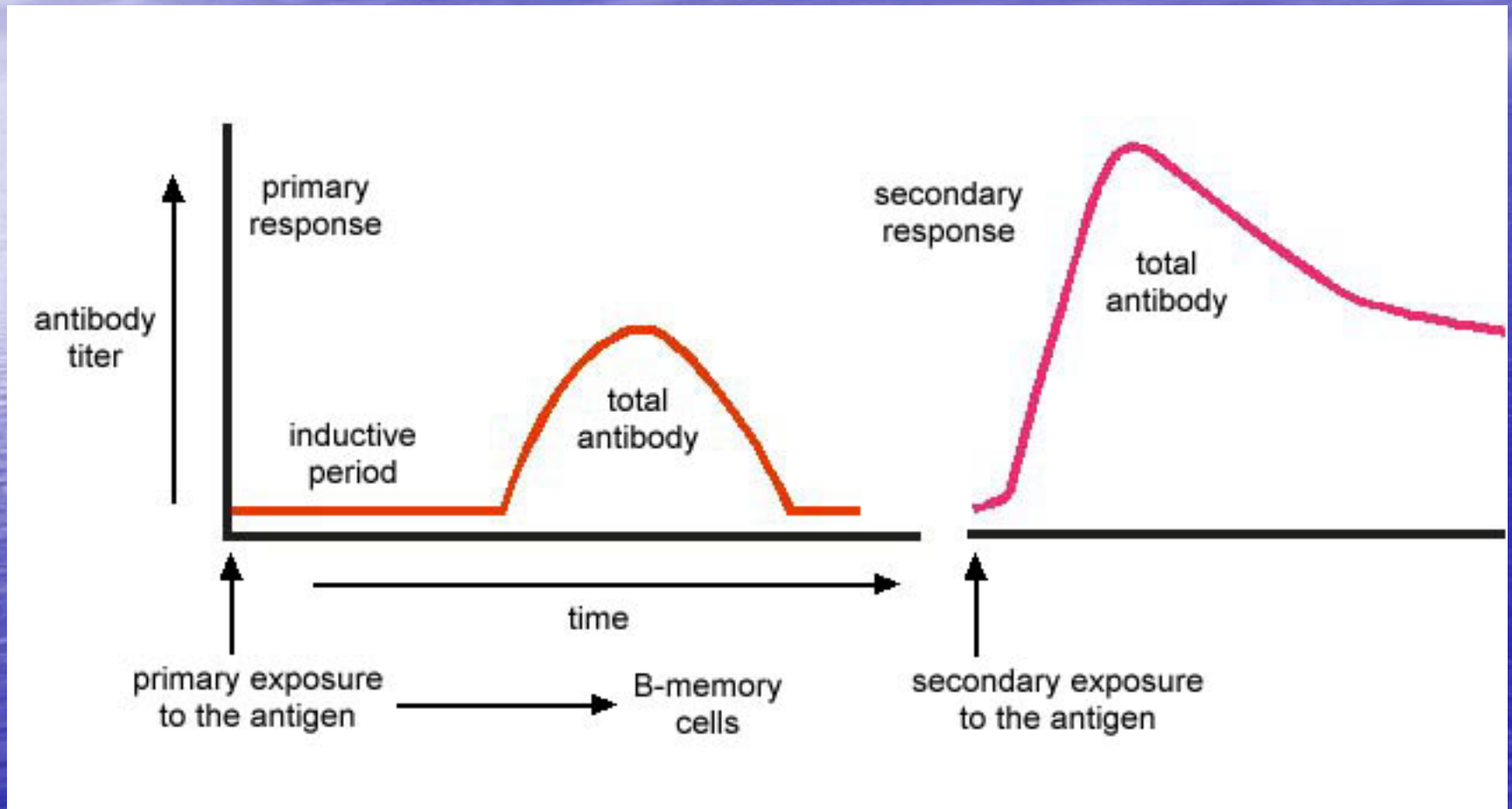


Adaptive Immunity

- Humoral –approx same as higher animals but:-
 - Only one class of antibody (“IgM”)
 - Pentameric but sulphide bonding variable, even in same cell; therefore polymorphic.
 - Found in blood, gut lining, skin mucus
 - Performs most of functions of many classes of mammals



Antibody Response



Antibody Response

- Not all antibodies are protective (e.g. p57kD)
- Circulating antibodies against specific pathogen do not necessarily reflect degree of protection
- Good protection can be achieved without detectable, specific antibodies

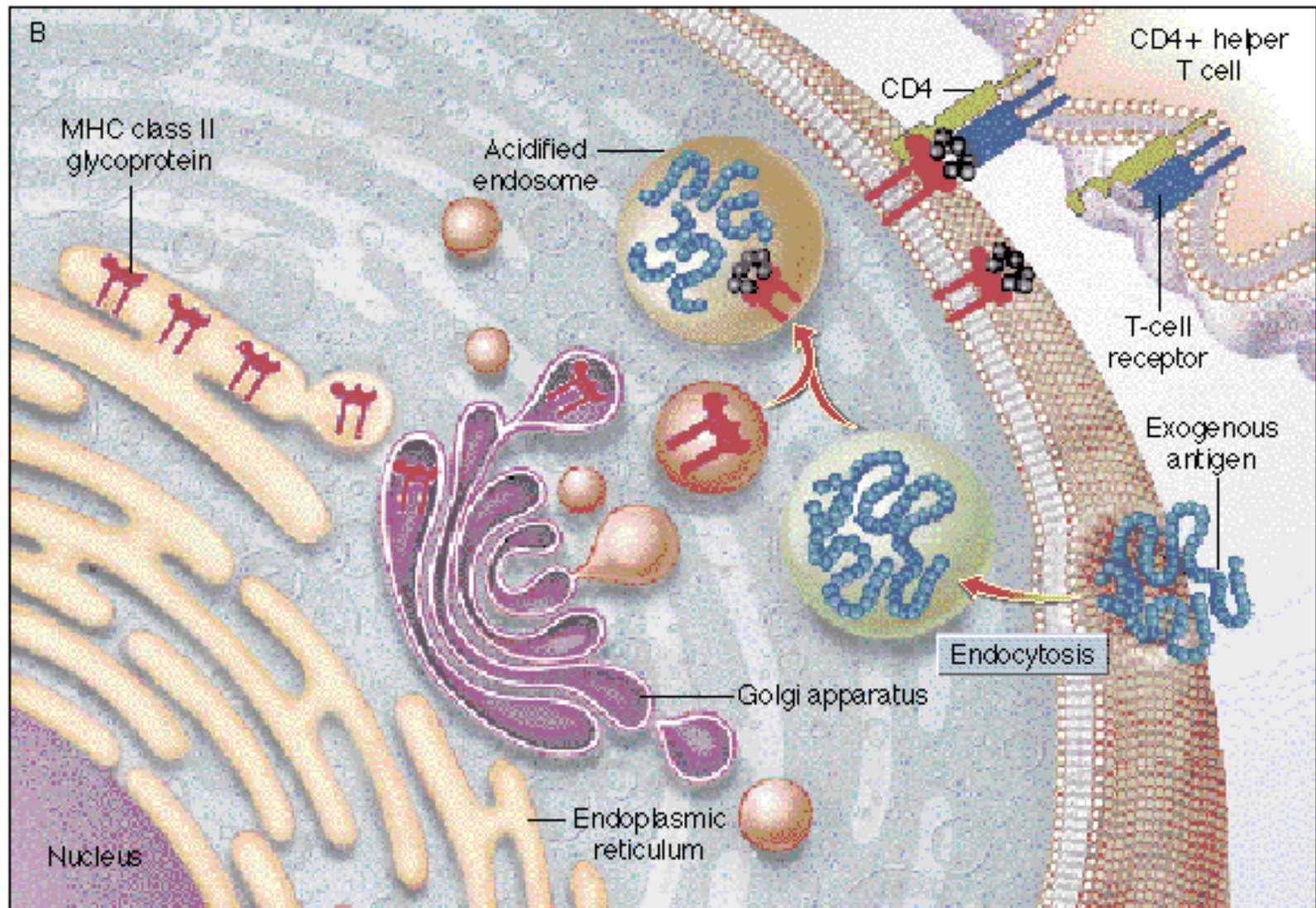
Temperature Effects

- Fish are poikilothermic animals (cf homoeothermic)
- Therefore:
 - All physiological processes are temperature dependent
 - Different species have different Permissive Temperatures
 - Initiation of immune response and rate are affected
 - All comparative data should be on a Degree Day basis

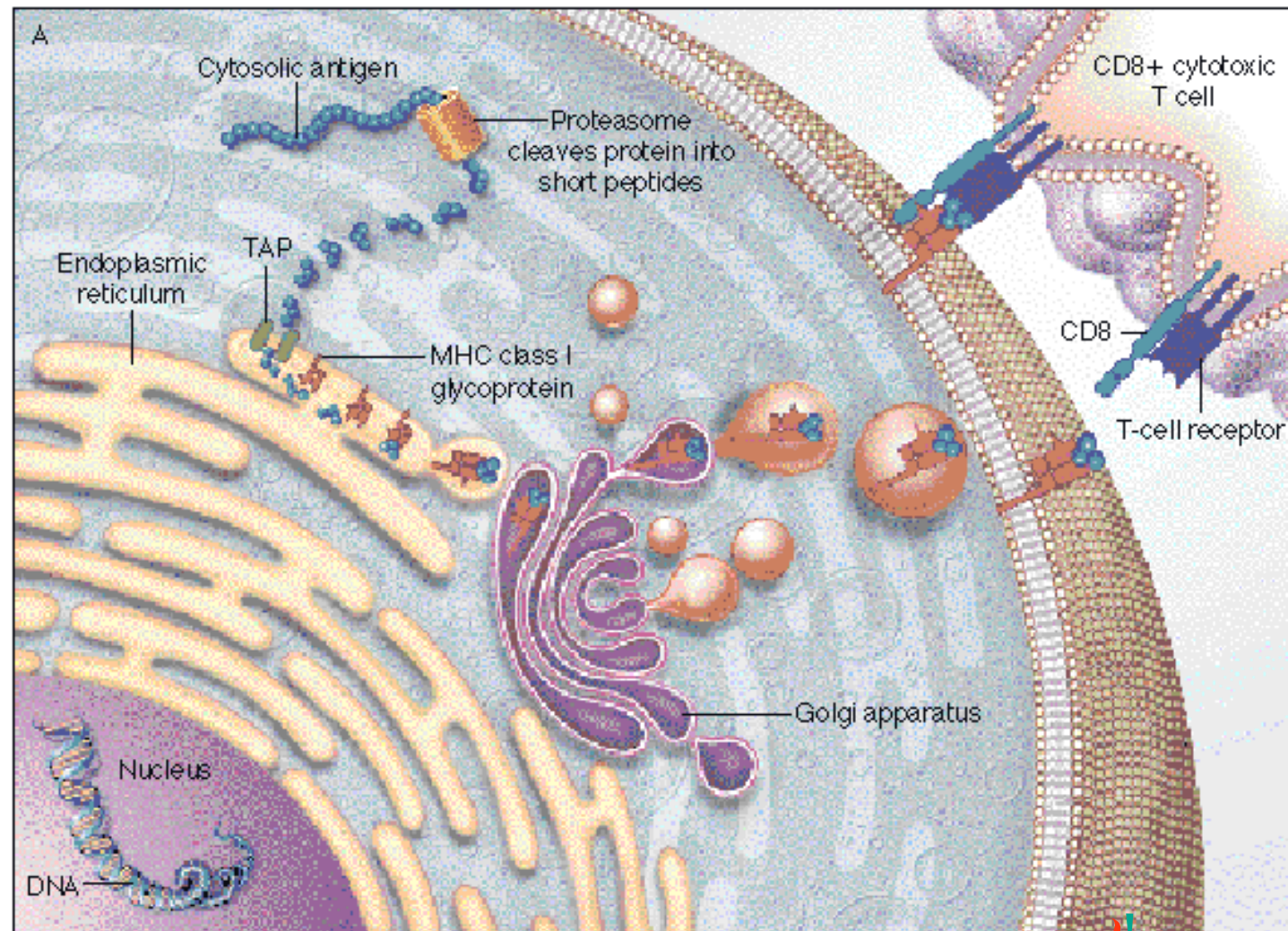
Cell Mediated Immunity

- Phagocytosis and killing of intracellular pathogens
- Direct cell killing by cytotoxic T cells
- Direct cell killing by NK cells

Exogenous Antigen Processing MHC Class II Response



Endogenous Antigen Processing MHC Class 1 Response



Cytokines in fish identified to date:

- **Chemokines:** IL-8, γ IP, MCP, RANTES, SDF
- **Colony stimulating factors:** GM-CSF, M-CSF
- **Interleukins:** IL-1 β , IL-6, IL-10, IL-11, IL-12 α , IL-12 β ,
IL-15, IL-16, IL-18
- **Transforming growth factor β**
- **Tumor necrosis factor α**
- **Type I Interferon**

Summary

- Well developed humoral function but structural differentiation not so clear
 - One, polymorphic Ig type (pentameric cf IgM)
 - Gut / Oral immunity but no Peyer's patches or M cells
 - Kidney has immune and renal functions
 - No lymph system
 - No bone marrow (haematopoiesis in kidney)
 - T & B cell function but differentiation difficult
 - Thymus implicated in T cell maturation
 - Most families of cytokines present with similar functions